

1. Can you list/describe emerging technologies that have the potential for radical improvement in a measurement capability over the next 30 years?

A) High stability optical platforms:

Includes optical benches, telescopes, etc, requiring passive thermal isolation for temperature stability. Hydroxide or silicate bonding for precision alignment capability and dimensional stability. Precision materials such as Silicon Carbide and single crystal silicon.

B) Precision interferometry:

Requires CW single-frequency and frequency-stabilized lasers for space (GSFC applications so far are pulsed). Digital techniques including coded modulation for time-of-flight resolvable interference, and flexible in-flight changes. Time-Domain Interferometry (LISA's equal-path-length synthesis techniques).

C) Frequency combs:

Could be used for LIDAR/remote sensing applications to distinguish types of vegetation and resolve shrubs vs. trees on a slope. Requires frequency stabilization, pulsed lasers, and good detectors.

D) single-mode fiber optic technology for space (now using multimode, mostly):

Now developed for wavelengths not usually used in space: 1550 nm

Fiber Bragg Gratings for frequency stability, references, and filters.

Modulators, isolators, and circulators. No alignment required and lightweight.

Changing traditional wavelengths to take advantage of telecom technology where possible

E) Scattered light suppression:

Includes masks and apodization, black coatings, and cleaning/particulate/contamination techniques.

F) Optical communications:

Phase-array capabilities would obsolete DSN or single-pointing-capable telescopes.

Orbiting TDRS-style relay network could obsolete DSN, form basis of a high reliability space-borne NETWORK for long-duration space flights/bases but also comm-constrained missions such as to the outer planets.

2. Of those technologies listed in question 1, can you identify those that cut across many different potential applications?

High Stability and/or fiber optics: atom interferometry, LISA, Grace, Exoplanets

Frequency combs: LIDAR/Remote sensing, atom interferometry

Scattered light suppression: atom interferometry, LISA, Grace, Exoplanets

Precision interferometry: optical communications, LISA, Grace

3. Can you list/describe measurement techniques that could enable new NASA missions not currently thought about in our agency strategic planning?

Precision interferometry and phase-sensitive optical detection (good for optical comm)

Frequency combs (sort of part of precision interferometry)

Time-Domain Interferometry